Ⅱ. INTERNATIONAL ACTIVITIES

International Academic Exchange and Cooperation of the Faculty of Agriculture, Kyoto University

Collaboration with Foreign Guest Professors

Collaboration with foreign guest professors during April,2008 and March, 2009 is shown in Table 1. The collaboration reports written by guest professors were attached at the end of this section.

International Cooperation and Overseas Activities

In recent years, international cooperation and overseas activities are actively carried out and many professors and students make research works abroad with foreign researchers. Please refer to "A-4. International cooperation and overseas activities" in each laboratory in "III. Research and educational activities" for the detail.

International student exchange program

We organized one of the subjects of liberal arts education, "International Exchange Program", in which first or second grade students in various faculties are dispatched to a foreign country or foreign students are accepted for about 2 weeks for international experiences. This year, one of the subjects, "Sustainable agriculture in Yunnan Province, China" was implemented by Faculty of Agriculture. Seven students were dispatched to Kunming University of Science and Technology during the period from 16th to 27th September. We accepted 10 students from the above University during the period from 16th to 28th August. In addition, as a part of a seminar "Tropical agriculture and environment" of liberal arts education, 12 students were dispatched to Kasetsart University, Thailand during the period from 6th to 18th September and 12 students were accepted during the period from 12th to 22nd October.

International Office and its activities in 2009

The International Office was established in June 1985 as an office to handle wide-ranged issues related to foreign students and research fellows at the Faculty. The number of foreign students by country in 2009 is shown in Table 2.

Major activities of the Office besides its regular tasks are as follows:

a) Orientation and welcome party

On April 8th the orientation and acquaintance session was held for newly enrolled foreign students. Dean Endo, Professor Nawata, a member of the University Committee for International Academic Exchange, administrative staffs of the Faculty, and an executive of the Kyoto University Cooperative gave guidance to the new comers on various aspects of the campus life. A welcome party was held thereafter at a "Camphora", in which about 70 students and staffs participated.

b) One-day study bus tour

The one-day study bus tours were organized. We visited Kyoto University Experimental Farm on May 28th. This year we also had an autumn bus tour. We visited Kyoto University Livestock Farm and Tamba Wine Houseon on October 23rd. Foreign students and visiting professors participated and studied Japanese culture. All the persons enjoyed and communicated each other very much.

c) Summer study trip

The study trip was organized to visit Tojinbo, Eiheiji temple, Tateyama, Kurobe/Tateyama Alpine route on July 27th—29th. In total 23 students and staffs participated in this trip. Everybody enjoyed very much and made a lot of friends.

d) Football game & Barbecue party

We had 8th World friendly Football game & Barbecue Party on June 13th. About 90 students and researchers enjoyed playing football. A Vietnamese team won the championship this year. After football games we had a Barbecue party, and foreign and Japanese students enjoyed the party together.

e) International Café Meeting

The office started international café meetings, “Hokkori Café” last year. One M1 Student Mr. Custodio Tacarindua offered the topic entitled, "Challenge of Mozambique and agriculture" on November 10th. About 25 researchers, students, and staffs participated in the meeting.

f) Special lecture

A special lecture entitled, “How to feel and think English” by Mr. Hiroki Sato who was the personality of FM Kyoto α-station was held on September 30th. About 160 students and faculty participated with his lecture. After his lecture, active discussion was performed.

g) Bazaar

The third northern campus bazaar was held on October 15th. Many things were offered by a students and faculty of Agriculture and Science Departments. Profits in the bazaar are used for international exchange activities.

h) “Mochituki” Ceremony

One of the traditional Japanese ceremony, rice cake pounding was held in the east side of the second building of Agriculture on January 14th. About 90 participants enjoyed rice cakes with soup, soybean powder, and bean jam etc.

i) The “dashi” experience course

The “dashi” experience course for international students and foreign researchers was held on February 22nd. After explanation about “dashi” by Dr. Hanae Yamazaki, Laboratory of Ajinomoto Integrative Research for Advanced Dieting, how to make “dashi” from seaweed and bonito was demonstrated by the master chef of a Japanese restaurant Kinobu, Mr. Takuji Takahashi. Many of the participants tasted the soup afterwards.

j) Japanese language class

The Japanese language class (beginner’s, intermediate and advanced courses) was started in April, 1996. About 30 foreign students and researchers attended the class this year.

k) Pre-counseling room

We started a pre-counseling room once a week from October, 2002. The object of our pre-counseling room is to release pressures of foreign students and to reduce their loneliness before they have serious problems. We were consulted about some problems for studying and Japanese daily life of foreign students.

l) Newsletter

Since 1988 the office has been publishing the newsletter biannually. This year, the 44th and 45th issues were published in September and March, respectively. About 3,000 copies each were delivered or e-mailed to all the students and staffs of the Faculty, visiting research scholars, foreign alumni residing in different countries (see Table 3), the members of the Supporters’

Association for International Academic Exchange of the Faculty of Agriculture, and various Faculties, institutes, centers and other offices in the campus.

m) Newspapers, periodicals and books purchased

Three newspapers (one English, one Chinese and one Korean) and several periodicals (2 in foreign language and 9 in Japanese) are subscribed. We have many books of studying Japanese language, Japanese culture and sightseeing.

n) Correspondence to inquiries

The Office answered a number of inquiries for admission from different countries.

Membership of the Supporters' Association for International Academic Exchange

International Academic Exchange of the Faculty of Agriculture comprises both academic and administrative staffs of the Faculty. The membership of the Association was renewed in July of this year. There are 124 individuals and 1 group in the membership list at the end of December. The activities of International Office are partially supported by the fund. A part of purchase of foreign newspapers and journals for the saloon is also made by this fund.

Table 1. Collaboration with Foreign Guest Professors

Name	Nationality	Affiliation	Research Title
Anderson, Darwin W.	Canada	University of Saskatchewan Professor	Development of Universal Model for Soil Carbon Dynamics
Mendoza, Evelyn Mae T.	Philippines	University of the Philippines Los Baños Research Professor	Structure and food function of seed storage proteins
Purcell, Larry C.	America	University of Arkansas Professor	An analysis on the environmental factors of different attainable yields of soybean between north and south regions
Xu, Zhengjin	China	Shenyang Agricultural University Professor	Improvement of quality and the efficiency of nitrogen and water usage of an extremely high yielding variety with erect pose panicle
Breiling, Meinhard	Austria	Vienna University of Technology Senior Lecturer	Sustainable Rural Tourism and Climate Change Adaptation in Japan
Hseu, Zeng Yei	Taiwan	National Pingtung University of Science and Technology Professor	Formation of caly minerals and effectof clay mineralogy on heavy metal dynamics in soils of humid Asia
Guilbert, Stephane	France	Biopolymer science and Process Engineering Montpellier SupAgro Professor	Studies on food engineering of water diffusion in food products
Gontard, Nathalie	France	University of Montpellier II Professor	Food scientific studies on preservation and safety of foods

Table 2　Number of foreign students by country (2009)

Country	UG	MC	DC	OT	ST	Country	UG	MC	DC	OT	ST
Argentina			2		2	Malaysia		1			1
Bangladesh			2	1	3	Mali			1		1
Bhutan			1		1	Mozambique		1			1
Bolivia				1	1	Myanmar			1		1
Brazil		2		1	3	Nepal			2		2
Cambodia			1		1	Nigeria			1		1
China	5	15	17	15	52	Philippines			1		1
Egypt			2		2	Spain				1	1
Ghana			1		1	Taiwan		1	1	5	7
India			3		3	Thailand	1	2	2	1	6
Indonesia	1	3	7		11	U.S.A.			1	1	2
Kenya		1			1	Vietnam		1	1		2
Korea	4	1	5	4	14	Zimbabwe				1	1
Lao			1		1						
						Total	11	28	53	31	123

Note) UG:Undergraduate, MC:Master Course, DC:Doctor Course, OT:Others, ST:Sub-total

Table 3　Number of foreign alumni by country of residence

Bangladesh	7	Iran	2	Philippines	9
Belgium	1	Japan	17	Poland	1
Brazil	7	Kenya	3	Spain	1
Bulgaria	3	Korea	51	Sri Lanka	6
Canada	1	Lao	2	South Africa	1
Chili	2	Macedonia	1	Switzerland	1
China	35	Malaysia	2	Taiwan	18
Congo	1	Mexico	5	Tanzania	4
Egypt	4	Myanmar	6	Thailand	47
France	2	Nepal	3	Turkey	3
Germany	1	Netherlands	2	U.S.A.	14
Ghana	1	New Zealand	1	Vietnam	2
India	4	Paraguay	1		
Indonesia	45	Peru	1		
				Total	318

Research Report

Dr. Darwin W. Anderson
Guest Professor
February to May, 2009

My appointment as a Guest Professor in the Soil Science Laboratory of the Division of Enviromental Science and Technology began on February 2 and ended on May 1, 2009. The time at Kyoto University was three months, making it difficult to undertake a research program involving experimental work. The time, however, was quite beneficial to me and my work as a Professor of Soil Science at the University of Saskatchewan. Hopefully, I have been able to contribute to research and knowledge here through the activities listed in this report.

The interactions with the people in Soil Science have been both enjoyable and good for me from a science perspective. I learned about some of the research by providing editorial advice on papers that were being written in English. Carefully reviewing and offering suggestions results in a good understanding of the content. I particularly appreciate working with Dr. K. Fujii on his paper dealing with dissolved organic carbon in tropical soils, a new area for me.

I attended the 'scientific English' class at which the students read one of my articles, "The Effect of Parent Material and Soil Development on Nutrient Cycling in Temperate Ecosystems". It was published in Biogeochemistry in 1988, Volume 5, pages 71 to 97. This was an interesting and beneficial experience for me, demonstrating how easy it is for small errors to slip by authors, reviewers and editors. The careful reading and translation by the students indicated the importance of science writing that is clear, straightforward, and does not use jargon that may be well-known locally but poorly understood by readers in a different country and/or language.

One of the purposes of my stay here was to familiarize students with the soils of Western Canada. The Canadian soils are quite similar to the soils of Central Asia, the location of field research by the faculty and students of the Soil Science Laboratory. There was consistent attendance at, and interest in, the three lectures on Canadian soils given in April to the graduate students. The first was on the soils of the grasslands, the second on the soils of forest regions, and the third on the soils of wetlands and permafrost regions. The final lecture entitled The Transformation of Agriculture in Western Canada discussed the change from summer fallow-based cropping systems to conservation tillage and continuous cropping. The similarity in soils and farming systems in Western Canada and the Chernozem zone in Kazakhstan is remarkable.

The Symposium of the Japanese Pedology Society on April 3 was one of the scientific highlights. My invited presentation was on the The Soils of the Central Interior Plains of Canada, consistent with the theme of the symposium, Soils of Continental Interiors. There were interesting papers by others, and an opportunity to meet both new and old friends. Dr. Shindo of Yamaguchi University, who was a visiting researcher at my university in about 1982, was at the symposium, and it was good to see him again.. The

field excursion following the symposium that was organized by Professor Funakawa permitted me to see the soils and landscapes of Wayakama Prefecture and the Kinki Peninsula . We observed the Brown Forest soils characteristic of this high rainfall area. Some of the trip was cultural in that we visited the Koya Temple and Ise Shrine, and stayed at traditional Japanese inns.

There were two excursions to research centers that were quite beneficial. The first, to the National Institute of Agro-Environmental Science in Tsukuba with Dr. Fujii was particularly valuable. Two Andosol soil profiles were observed, with good discussion of their formation by Dr. T. Ohkura. The National Soils Museum was visited, impressive for the large number of displays with soil monoliths, and for the technique for taking soil monoliths. The second excursion was to the Fukushima Agricultural Technology Center in Koriyama, to visit with a former student, Dr. Masae Takeda. The Center is impressive, both beautiful in design and practical. Related to this visit was a field excursion an organic rice farm, and an opportunity to observe the rice seeding, and observe soils in the region. The mechanized planting of rice was observed in Tetayama, on a week-end excursion with Dr. Fujii.

In summary, the three months spent at Kyoto University have been both enjoyable and scientifically beneficial for me. I trust that my interaction with the faculty and students in Soil Science has been beneficial for them, and wish them every success in future research endeavors.

REPORT AS VISITING PROFESSOR

Evelyn Mae Tecson Mendoza, Visiting Professor
Laboratory of Food Quality Design and Development
Division of Agronomy and Horticultural Science
Graduate School of Agriculture
KYOTO University

Duration: March 23-June 22, 2009
Host and Collaborating Scientist: Associate Professor Nobuyuki Maruyama

Activities:

1. Teaching of Comparative Agricultural Series: Understanding Modern Biotechnology I am pleased to have been invited by the Graduate School of Agriculture to give a series of lectures on the topic of my choice under the Comparative Agricultural Series. I think this kind of course exposes students to fields and topics beyond what they are studying or doing in their respective researches and gives them a wider perspective. I chose the topic "Understanding Modern Biotechnology" with the course description of "Overview of modern biotechnology, its applications, regulation and technological and social issues." The outline of the course is in Appendix I. Because I would be here for only three months and for time efficiency, the course was scheduled to consist of five lectures at 3 hours each time. It is always a challenge to give such long lectures for the lecturer as well as for the students or audience.

While many students have knowledge of the principles and some applications of molecular biology and biotechnology, they are not aware of the issues and concerns of biotechnology, and interactions of biotechnology (and other new technologies) with society. Indeed, in the three papers that they were required to write, especially in the third one, they expressed surprise that biotechnology researches and products, specifically agricultural products, are heavily regulated from research to commercialization but expressed satisfaction in the comprehensiveness and rather strictness of the Japanese biosafety regulation. The students also noted that the low acceptability of genetically modified foods in Japan is due to lack of information and if there was information, it was always

negative write up on genetically modified (GM) foods. From the studies done on acceptability in Japan and in other countries, the more people are knowledgeable on biotechnology, the greater the rate of acceptance of the technology. The students realized that while researchers accept and utilize recombinant DNA technology in research works in universities and research institutions, the public knows little about the technology and thus fears the technology and its products. Thus, many of the students recommended the active dissemination of information on biotechnology for greater public acceptance.

2. Continuing Collaboration on Storage Proteins

In the past ten years, we, at the Institute of Plant Breeding, University of the Philippines Los Banos, have conducted studies on the storage proteins of seed endosperms particularly of mungbean (Vigna radiata [L.] Wilczek) in collaboration with Professor Shigeru Utsumi and his laboratory, Kyoto University Graduate School of Agriculture. This collaboration has resulted in the training of staff and students from the Philippine side at Kyoto University, the publication of four articles (Appendix IIA) and the enrichment of the knowledge and scientific data and information on mungbean storage proteins.

We isolated, purified and characterized the storage proteins of mungbean which consist of the basic 7S, 8S and 11S, with 8S or vicilin as the major globulin at 89% (Tecson-Mendoza et al, 2001). Using DNA probes based on the N-terminal sequences of the globulins we obtained in said study, we proceeded to clone and characterize three isoforms (8Sα, 8Sα' and 8Sβ) of the 8S cDNA (Bernardo et al 2004). The 8Sα, the major isoform, was expressed in Escherichia coli and purified to homogeneity. The purified recombinant 8Sα was successfully crystallized into rhombohedral crystals but not the native 8S globulin. The recombinant protein was found to assemble into trimers and form secondary structures as shown by circular dichroism spectral analysis similar to the native 8S globulin (Garcia et al 2006). This study showed that the N-linked glycans which are absent in the recombinant protein, is not essential in the assembly and stable conformation of the mungbean vicilin. However, the N-linked glycans might have contributed to the higher solubility at low ionic strength, greater thermal stability, and decreased surface hydrophobicity but had no effect on the emulsifying ability of the native vicilin compared to the recombinant form. The X-ray crystallographic analysis of the recombinant 8Sα globulin was determined for the first time (Itoh et al, 2006). With the exception of several disordered regions, the 8Sα globulin structure closely

resembled those of other seed storage 7S globulins, with highest similarity to soybean β-conglycinin β (7S globulin). Although their surface hydrophobicities were similar, their solubilities differed under alkaline conditions at low ionic strength. The thermal stability of the 8S α was lower than that of soybean β-conglycinin β which correlates with the cavity size of the crystal structure although other structural features could have little effect on thermal stability.

In 2005, we started work on the protein engineering of mungbean vicilin or 8S globulin to improve its functional properties and nutritional quality. Thus, a PhD student (Mary Ann O. Torio) came to Utsumi laboratory in mid-2005 to train on protein engineering, specifically, to design and introduce sulfhydryl and disulfide linkage to the mungbean 8S α globulin. She successfully conducted the study in three months and came back to the Philippines to continue the work on introducing up to ten Met residues in the 8S α globulin. The Met-rich proteins were shown to form trimers like the wild type, were expressed in soluble form in relatively high levels, had greater heat-induced gelation property and were not potential allergens. In 2007, she completed the study and obtained her PhD degree from UPLB. Two scientific articles from this work on protein engineering of mungbean 8S globulin were revised thoroughly during my stay in Kyoto University. The online access to international journals and the technical help of collaborators in Japan, Associate Professor N. Maruyama, Dr. Motoyasu Adachi, now with Japan Atomic Energy Agency, and Dr. Takafumi Itoh contributed to the improvement and completion of the two manuscripts which will be ready soon for submission to an international journal. The titles of the articles and their authors are in Appendix IIB.

3. Special lecture

I gave a special lecture on the topic "Towards Improving the Functional and Nutritional Qualities of Mungbean Storage Protein" on June 12, 2009 at 1300 to 1400 at the Graduate School of Agriculture/Biostudies Seminar Room 101. I presented the ten-year collaborative research we have done with the late Prof. Utsumi (please see above for highlights of collaborative work).

4. New Area for Collaborative Research: Cloning of the Oleosin and Cocosin Genes from coconut

We have been working on the storage proteins of coconut, primarily on the major storage protein called cocosin, an 11S globulin and the oil body protein oleosin. To further understand the nature and functions of the storage proteins and oil body protein of coconut and their possible role in coconut allergenicity, we started work on the following in collaboration with Assoc. Prof.

Maruyama: (a) to clone the full length cDNAs of the 11S globulin (cocosin), 7S globulin and oleosin, (b) characterize the DNA sequence derived amino acid sequence and (3) to determine the possible allergenicity of the 11S and 7S globulins and oleosin by comparison of their amino acid sequences with allergens of known structure. With the help of doctoral student Cerrone S. Cabanos, work on this study was started. We have designed primers for the genes of cocosin and oleosin. We have recently obtained the putative complete sequence of one isoform of oleosin, the OLE 300a and are continuing the cloning of the obtained plasmids for DNA sequence. The cloning of the cocosin gene is also ongoing.

Future work will include expression of the recombinant proteins in E. coli for characterization and eventual crystallization and structural analysis. Some of the characterization work will be done in the Philippines while structural analysis by X-ray crystallography will be done in Kyoto University.

5. Others

I attended the Fourth iCeMS International Symposium on May 28, 2009, a symposium organized by the Institute fo Integrated Cell-Material Sciences, Kyoto University.

I also visited the Innovative Collaboration Center and talked with Professor Noriyuki Ikeuchi about the programs and activities of said center on June 19, 2009.

Acknowledgements:

I sincerely thank Kyoto University Graduate School of Agriculture for the appointment as Guest Professor, to the late Professor Shigeru Utsumi for his friendship, collaboration for the past ten years and endorsement of this appointment, and to Associate Professor Nobuyuki Maruyama for hosting my stay at this time and his kind assistance. I am also grateful to Assistant Professor Katsuko Morita of the International Office in Agriculture, Faculty of Agriculture, for her kind assistance.

Appendix I. Course Outline of UNDERSTANDING MODERN BIOTECHNOLOGY

Description: Overview of modern biotechnology, its applications, regulation and technological and social issues.

Course
Goals:
For students to gain an overview of biotechnology especially as it is applied in various industries worldwide and knowledge and information on the technological and social issues of biotechnology and the regulatory systems that research and products of biotechnology are subjected to, and to enable them to discuss issues, exchange ideas and to make their own informed decisions.

Topic Number of meetings (1 hr per)
1.0 Introduction: an overview of the course 1
2.0 Modern biotechnology, principles and applications 1
3.0 Social issues and concerns 4
3.1 Ethics
3.2 Socio-cultural dimensions: biodiversity, community and political
3.3 Intellectual property rights
3.4 Socio-economic issues
4.0 Technological issues and concerns 4
4.1 Environmental concerns
4.2 Food and feed safety
5.0 Biosafety regulation of modern biotechnology R & D and products 3
5.1 Basic principles
5.2 Practices in Japan, Philippines, other Asian countries, US and Europe
5.3 Principles of science-based risk assessment
6.0 Adoption and acceptability of biotech products 1
7.0 Biotechnology-based industry (bioindustry) 1 15

Course Requirements: 3 short reaction papers

Appendix II. A. Papers published under this collaboration:

Tecson-Mendoza EM, Adachi M, Bernardo AEN and Utsumi S. 2001. Mungbean [Vigna radiata (L.) Wilczek] globulins. Purification and characterization. J Agric Food Chem 49: 1552-1558.

Bernardo AEN, Garcia, RN, Adachi M, Angeles JGC, Kaga A, Ishimoto M, Utsumi S and Tecson-Mendoza EM. 2004. 8S Globulin of mungbean [Vigna radiata (L.)

Wilczek]: cloning and characterization of its cDNA isoforms, expression in Escherichia coli, purification, and crystallization of the major recombinant 8S isoform. J Agric Food Chem 52: 2552-2560.

Garcia RN, Adachi M, Tecson-Mendoza EM, Bernardo AEN and Utsumi S. 2006. Physicochemical properties of native and recombinant mungbean [Vigna radiata (L.) Wilczek] 8S Globulins and the effects of the N-linked glycans. J Agric Food Chem 54: 6005-6010.

Itoh T, Garcia RN, Adachi M, Maruyama Y, Tecson-Mendoza EM, Mikami B, and Utsumi S. 2006. Structure of 8S α globulin, the major seed storage protein of mungbean. Acta Cryst D62, 824-832.

B. For publication

Torio MAO, Adachi M, Garcia RN, Prak K, Maruyama N, Utsumi S and Tecson-Mendoza EM. Engineering methionine in the 8S α globulin of mungbean results in Met-rich mutant proteins with stable conformation and improved nutritional and functional properties. For publication.

Torio MAO, Itoh K, Garcia RN, Maruyama N, Utsumi S and Tecson-Mendoza EM. Introduction of sulfhydryl groups and disulfide linkage to mungbean 8s α globulin and effects on physicochemical and functional properties. For publication.

Joint Research Report, 3 September 2009

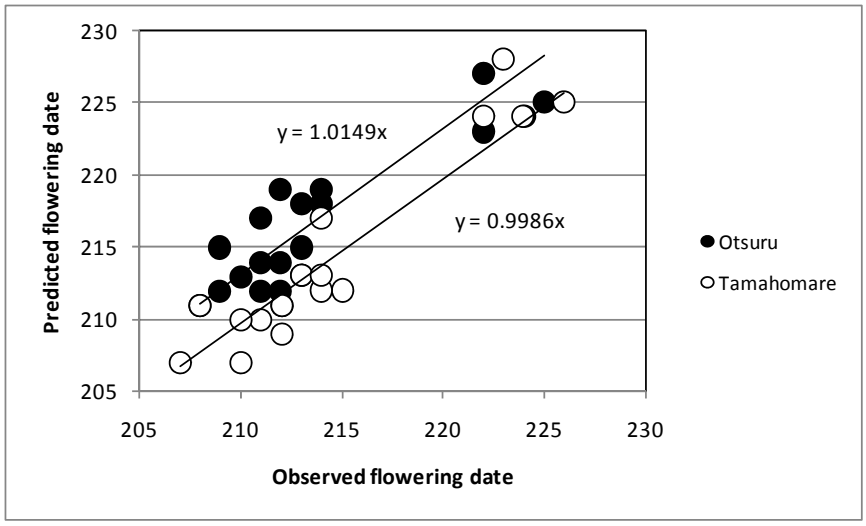
Larry C. Purcell, Visiting Professor, University of Arkansas, USA and
Tatsuhiko Shiraiwa, Professor, Crop Science Laboratory, Kyoto University

The primary objective of our joint research project was to determine reasons for higher soybean yields in the US with those of Japan at similar latitudes. Collaborative research efforts were begun in 2008, at which time a common set of soybean varieties from Japan and the US were grown at locations in both Japan and the US. At both locations, environmental data throughout the growing season were collected along with phenological notes, data on light interception, harvest index, and yield.

In the US, Japanese varieties were prone to seed loss from shattering and lodging, and consequently had substantially lower yields than US varieties. In Japan, shattering losses were minimal and yields of both Japanese and US varieties were generally above 4 tons/ha.

In 2009, Dr. Shiraiwa and I expanded our experiment to include physiological measurements to be taken. These measurements were designed to characterize the seed-fill period and to evaluate the rate at which nitrogen was remobilized from leaves during seed fill. While in Japan this summer, I was able to visit these experimental sites with Dr. Shiraiwa and participate in the planning and analysis of these experiments.

A second phase of the research was the construction of a crop simulation model that would allow an assessment of the environmental factors important for soybean yield in Japan. Two representative soybean varieties from Japan were chosen to characterize, Otsuru and Tamahomare. The first step was to determine the response of the developmental rate towards flowering to daylength and temperature. Dr. Shiraiwa was able to collect experimental data from several locations in Japan in which these varieties were sown at different dates. From these data we were able to construct statistical models that allowed accurate prediction of flowering dates based upon daily average temperatures and daylengths beginning from crop emergence. In the figure below is a comparison of the predicted flowering date and the observed flowering date for experiments collected at a number of sites in Japan.

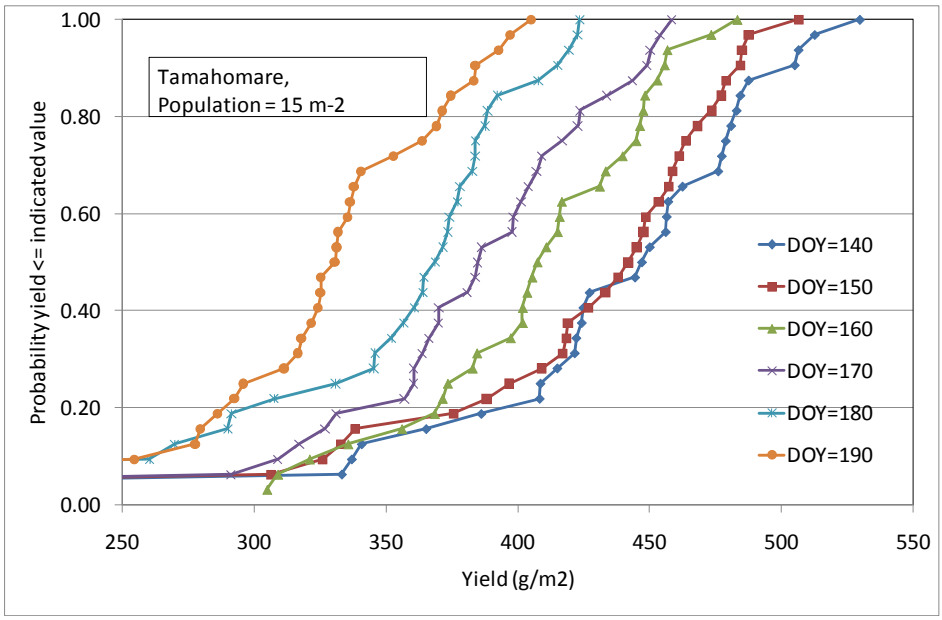


The ability to predict flowering date is a key component of the simulation model we are using. The next step in our analysis was to determine whether our model would predict yield well for conditions in Japan. Previously, the model had been used extensively in the

US and South America. Our initial results with the simulation model were very disappointing in that yields were consistently under-predicted compared with observed experimental yields.

Dr. Shiraiwa and I determined that the original model was not accounting for the large amount of branching that typically occurs in Japanese soybean varieties when grown at considerably lower population densities than those used in the US and South America. The result was that the model predicted that less cumulative light was intercepted during the season, resulting in less photosynthesis and lower yields than what actually occurred. A subroutine was added to the model which allowed from one to six branches per plant to begin developing 20 days after emergence depending upon the amount of incident radiation was reaching the soil surface. The addition of this simple subroutine improved model performance. The model now predicted yield well when yields were greater than 3.5 tons/ha. Below 3.5 tons/ha, predicted yields were greater than observed yields. Dr. Shiraiwa and I believe that over-prediction of yields when observed yields were low represents some loss not accounted for in the model. This could include biotic factors (e.g., insect damage, weed infestation, disease) or an unaccounted weather event (e.g., typhoon).

The model is now able to predict 'potential yields'. That is, the model provides an assessment of the best yields possible given the solar radiation, temperature, and soil moisture for a given environment. By having long-term weather data for different locations we are now evaluating how implementing different management factors may affect 'potential yield'. For example, in Shiga, soybean is typically planted around 19 June (Day of Year, DOY, 170). We used the simulation model to predict yields with weather data collected over a 32-year period (1976 to 2007). In the figure below, the probability of attaining a given yield level over this 32-year period is plotted on the y-axis against a range of yield values on the x-axis. This analysis shows that mean yields (probability of 0.5) increased from approximately 375 g/m2 when planted on DOY 170 to 450 g/m2 when planted 20 days earlier (DOY 150). Dr. Shiraiwa and I plan to continue our collaboration to determine what factors may be preventing soybean from reaching its 'potential yield' in many environments.



Report on collaborative research with Kyoto University

Guest Professor: Zeng-Yei Hseu
Home Institute: Department of Environmental Science and Engineering, National Pingtung University of Science and Technology, Pingtung, 91201, Taiwan
Host Professor: Shinya Funakawa and Tetsuhiro Watanabe
Host institute: Soil Science Lab, Graduate School of Agriculture

Japan and Taiwan are both in the West Pacific regions where serpentine soils have been intensively found on such convergent belts between Euro-Asian Plate and Pacific Plate. Serpentine soils were derived from ultrabasic rocks mainly dominated by serpentine group minerals. Regarding crop production and environmental quality, these soils are important because of their extremely low Ca/Mg ratios and high contents of heavy metals (i.e. Cr, Ni). I have started in the studies of serpentine soils related to the issues in mineral transformation and heavy metal dynamics at my home institute (Department of Environmental Science and Engineering, National Pingtung University of Science and Technology, Taiwan) since approximate 5 yrs ago. In 2007, I knew Assistant Professor T. Watanabe during 8th East and Southeastern Asia Federation of Soil Science Societies (ESAFS 8) held in Japan. He is an active and young soil mineralogist from Soil Science Lab, Division of Environmental Science and Technology, Graduate School of Agriculture, Kyoto University (KU).

When I planed for my sabbatical research in abroad, Kyoto University was highly attractive to me due to: (1) there are serpentine soils in Kansai district of Japan, (2) the scientists at KU are always outstanding in the performance of soil science with greatly international eyesight, and (3) Kyoto can cover most parts of typical Japanese cultures like numerous historic records and buddhistic buildings which have been imaged in my mind since my learning time. Therefore, I was in the employ of the Graduate School of Agriculture, KU during the period from Feb. 1st, 2010 to Apr. 30, 2010 as a guest professor hosted by Prof. S. Funakawa and Assistant Prof. T. Watanabe for our collaborative studies in Japanese and Taiwanese serpentine soils. Due to the increased use of serpentinitic soils in agricultural production, the objectives of this study are: (1) to understand the variation of total and extractable Ca/Mg ratios in the serpentinitic soils from paddy field and forest in Taiwan and Japan, (2) to compare the contents of Cr and Ni with the different agricultural land uses in the West Pacific regions, and (3) to indicate the relationship between Ca/Mg ratio and availability of Cr and Ni in these soils.

We investigated 6 soil pedons from paddy field and forest in eastern Taiwan and

Yabu-city of Japan and analyzed 72 soil samples to explore elemental (Ca, Mg, Cr, and Ni) chemistry and mineral transformation with different land uses. From the primary results, the values of total Ca/Mg ratio were always lower than 1.0, indicating all soils were potentially Ca deficient for plant growth (Fig. 1a). However, the paddy soils may have much higher exchangeable Ca/Mg values than the forest soils, because clear Ca sources increased through the fertilization and input of rice stalk during long-term cultivation of paddy rice. Additionally, total contents of Cr and Ni were not only much over natural background levels of world soils (Fig. 1b), but also the correlation between the elements was significantly positive to verify the elemental sources from serpentinitic minerals. Average total and bioavailable concentrations of Cr and Ni were higher in the Japanese soils than Taiwanese ones. The depth trends of total Cr and Ni were variable in the pedon of Japanese paddy field, which was well corresponding to the alluvial impact on parent material contamination with sedimentary rocks on the river terrace through field observation. However, an overall poignant question is raised: “do the mineral origin and weathering control the soil fertility in Ca and Mg and bioavailability of Cr and Ni in association with forest management and rice production?”

X-ray diffraction (XRD) results were corresponding to the dynamics of the elements. Clinopyroxene (main Ca mineral source) was found in the sand fraction of soils, serpentine was gradually decomposed from the C horizon to surface soil, Cr-bearing minerals such as chromites were trace, and primary Ni-oxides was hard to be identified by XRD. The bioavailable concentration of Ni was always higher than that of Cr, but the succession of exchangeable Ca and Mg did not follow the trend of bioavailability of Cr and Ni particularly in the paddy soils. These interesting findings will be presented in available international conferences and journals. Three months is not a long time to me, and thus I will go on the unfinished exploration from the collaborative data after my arrival in my home institute.

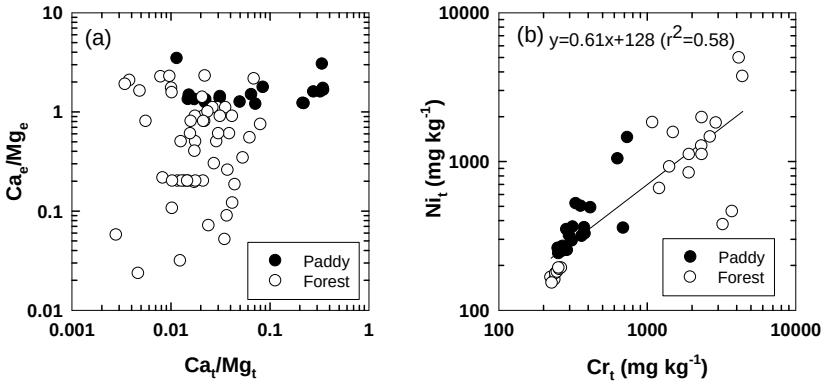


Fig. 1. The correlation between total content and exchangeable form in Ca/Mg (a) and between total content in Cr and Ni (b) from the collaborative soil samples.